Repetitive surface cleaning effects on process performance of an EUV mask

Simi George, Lori Mae Baclea-an, Patrick Naulleau, Robert Chen, Ted Liang

Simi George, Lori May Baclea-an, Patrick Naulleau
Center for X-Ray Optics, Lawrence Berkeley National Laboratory

Robert Chen, Ted Liang
Intel Corporation

EUV mask are expected to undergo cleaning processes in order to maintain the lifetimes necessary for high volume manufacturing. For a mask cleaning process to be practical, negligible negative impact on mask performance after repeated cleaning is a requirement. Mask surface damage and the increased LER that may result from repetitive cleaning still remains a concern. For this study, the impact of the repetitive cleaning of EUV masks on imaging performance was evaluated.

We useD to, high-quality, industry standard, EUV mask; with one of the masks undergoing repeated cleaning and the other one kept as a reference. The SEMATECH Berkeley 0.3 NA microfield exposure tool (MET) patterned 40 nm and 36 nm equal lines and spaces are evaluated for process changes. Exposure data from these two mask with the same architectures were collected using the same resist and exposure conditions prior to the start of the cleans. Lithographic performance, in terms of process window analysis and line-edge roughness, were monitored after two cleans and compared to the reference mask patterns. The cleaning cycles were continued until significant lost in imaging fidelity is found.